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Use of the Multiple Launch Rocket System (MLRS) in Military Operations on Urbanized Terrain (MOUT)

A Review of Doctrinal Literature

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Introduction

The proper application of fire support assets is a critical planning factor in any combat situation. Successful employment of MLRS in MOUT requires exceptional planning and C2 down to the launcher level.

The purpose of this review of doctrine is to provide a background to non-fire supporters about MLRS and its potential application in MOUT. This review relies heavily on the concepts and tactics, techniques and procedures (TTP) found in FM 6-60 and supporting ideas from FM 6-50. The review is not limited to the short section on MOUT in FM 6-60, but includes a summary of relevant background factors for maneuver commanders and planners to consider. It is not a comprehensive report on the overall use of MLRS. Other associated doctrinal issues, such as logistical demands, weapons maintenance, and training programs in MOUT are not addressed here. Each of those issues, however, remain vital and deserve the attention of future research efforts.

Full endnote citations are included in this review. Ibidem referencing for multiple use from the same source was not used in order to enable Microsoft Word users to simply cut and paste reference material with endnotes intact. Quote marks are also not used. All items below are quoted verbatim from doctrinal sources except the conclusion paragraph. Some words were deleted using ellipses to ensure contextual continuity.

Purpose for MLRS

MLRS units are employed to provide FA medium range rocket and long range missile fires in support of the corps, Army, theater, joint or coalition forces and Marine MAGTFs or in the conduct of TMD to destroy, neutralize or suppress the enemy in accordance with Army depth and simultaneous attack doctrine. Successful MLRS operations start with a sound organization for combat that maximizes MLRS capabilities. Key to this process is a complete understanding of employment considerations and a thorough analysis of the factors of METT-T (mission, enemy, terrain, troops, and time available).[1]

Capabilities and Limitations in MOUT

The massive growth of urban areas and manmade changes to the landscape significantly affect the conduct of future battles. Commanders at all levels must be aware of the unique advantages and disadvantages associated with operations conducted in and around cities, towns, villages, and similar built-up areas. Special techniques may be used in attacking the defilade areas between buildings. Increasing the target altitude used in the Fire Direction System (FDS) and Fire Control System (FCS) will allow the submunitions to achieve a more vertical fall prior to detonation and thus clear buildings and other obstructions (see Figure 1). Commanders must still consider the precision error and large submunitions dispersion patterns when applying this method of attack due to the high probability of

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extensive collateral damage. Low-level winds at the target area will add to the precision error. At longer ranges, large altitude adjustments may yield a "NO SOLUTION ERROR" in the launcher FCS.[2]

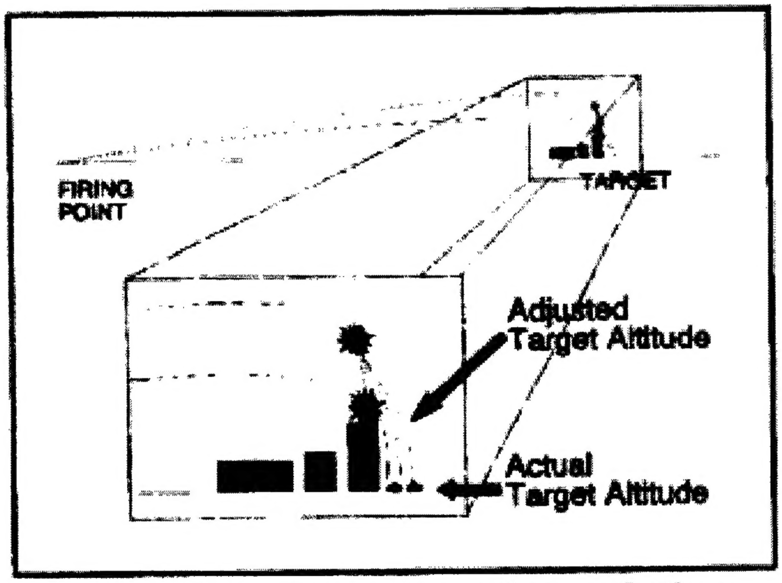

Figure 4-6. Urban targeting solution.

Figure 1. Figure 4-6 from FM 6-60

C2 of a firing platoon operating in an urban area is demanding. Decentralization to the maximum feasible extent may be required. The reduced ability to communicate necessitates more detailed orders and SOPs. The height and density of structures reduce the planning ranges for all organic radio equipment. Imaginative positioning of antennas for the platoon HQ, such as intermingling them with existing civilian antennas or in treetops, may increase transmission range and enhance survivability. Existing civilian communications networks may be used to supplement the organic capability of the unit.[3]

MLRS units should not position launchers in built-up areas. Buildings can serve as concealment for hide areas, but the low trajectory of the system necessitates open areas for firing. Any urban area used for hide or CP positions should--[4]

- Be free of civilians.
- Be away from the center of the built-up area.
- Have several routes of escape.
- Be off the main high-speed avenues.
- Afford as much cover and concealment as possible.

The use of existing structures (such as barns, auto repair shops, and warehouses) as hide areas or CP locations maximizes protection and minimizes the camouflage effort.[5]

More time must be allotted for reconnaissance. Depending on the density of buildings in the area, the reconnaissance party may have to use infantry techniques for house-to-house fighting to clear and check

the buildings.[6]

COMMAND AND CONTROL

Command and control of a firing platoon operating in an urban area are demanding. Decentralization to the maximum feasible extent may be required. The reduced ability to communicate and extended platoon frontages necessitate more detailed orders and SOPs. Tactical communications in the firing platoon area are severely affected. The height and density of structures will reduce the planning ranges for all organic radio equipment. Wire takes on added importance. It is less vulnerable to disruption if run on existing telephone poles or through buildings and sewers. More use must be made of messengers and prearranged audio and visual signals. Imaginative positioning of antennas, such as intermingling them with existing civilian antennas or in treetops, may increase transmission range and enhance the survivability of the unit. Existing civilian communication networks should be actively sought out and used to supplement the organic capabilities of the unit.[7]

POSITIONING AND DISPLACEMENT

When field artillery is used in an urban environment, selected position areas should--[8]

- Be free of civilians.
- Be away from the center of the built-up area.
- Minimize masking.
- Have several routes of escape.
- Be off the main high-speed avenues.
- Afford as much cover and concealment as possible.

The use of existing structures (such as barns, auto repair shops, and warehouses) as firing or hiding positions provides maximum protection and minimizes the camouflage effort.[9]

More time must be allotted for the reconnaissance of potential position areas. Depending on the density of buildings in the area, the reconnaissance party may have to use infantry techniques for house-to-house fighting to clear and check the buildings.[10]

Special techniques for the emplacement of howitzers may be required if the ground is not suitable for normal emplacement. Consideration should be given to placing howitzer spades against curbs, rubble, or building walls. Also concrete or asphalt surfaces may also be softened for howitzer emplacement by use of shaped charges.[11]

Because of the expanded occupation required in the urban area, displacement by platoon may be impossible. In this case, displacement may be by howitzer section.[12]

OTHER CONSIDERATIONS

Plotting of current friendly positions...down to platoon or squad level, may be critical in reducing incidents of fratricide.[13]

Employment Considerations

Close Operations. In the close fight, MLRS best supports the maneuver commander with rocket fires. MLRS rocket range exceeds most cannon munitions and allows maneuver commanders the opportunity to augment cannon fire with a lethal indirect fire capability enhancing maneuver force protection. In close operations, MLRS can be used for counterfire, raids, suppression of enemy air defense (SEAD), and engaging targets beyond the FLOT that will impact upon the close battle. The targets best suited for MLRS in the close fight are personnel, light materiel, CPs, and self-propelled artillery. The MLRS M26 rocket has a large "footprint" (dispersion of submunitions in the target area) and therefore requires detailed planning in close operations. Planners should ensure that the MLRS footprint and probability of dud munitions in the target area are considered by maneuver commanders when synchronizing battle plans. The same planning factors for 155-mm or Air Force-delivered DPICM will provide acceptable data for planning in close operations. Specifically, they must be careful not to assign missions or targets that are closer than 2000 m to friendly troops. Some risk will be accepted when firing MLRS into areas friendly units could occupy or pass through during future operations.[14]

Deep Operations. Army doctrine (FM 100-5) requires the field artillery to provide deep fires and fires in support of other deep operations. The MLRS can support the commander's deep operations plans with M39 (Army TACMS) missile fires normally fired by corps GS MLRS units. With a range of 165 km, the M39 is well suited for attack of long-range, high payoff targets (HPTs). This includes attack of HPTs with extremely short dwell times where minimizing the time from acquisition to firing (sensor-to-shooter time) is critical. Chapter 4 discusses options for posturing units and Chapter 5 discusses methods to reduce processing times in these situations. The range capability also allows engagement across the front laterally. The methodology for planning and executing deep operations is decide-detect-deliver-assess (D3A). This methodology requires that targets and their areas of engagement be planned during the decide phase. In deep operations, most fires are planned and scheduled as opposed to immediate, unscheduled fires on targets of opportunity. In the planning process of the decide phase, the following must be considered:[15]

- The M39 missile stockage levels and locations. Management and delivery of munitions depend heavily on fire planning decisions made early in the decide phase.[16]
- Target acquisition (TA) and sensor system availability, C3 linkage to the MLRS firing unit, and target acquisition and sensor systems cuing to detect and/or track targets.[17]

Elements of Accurate Predicted Fire

Requirements for Accurate Predicted Fire

There are fire general requirements for achieving accurately predicted fire. These requirements are accurate target location and size, firing unit location, weapon and ammunition information, met information, and computational procedures. If these requirements are satisfied, the firing unit will be able to deliver accurate and timely fires.[18]

- **Target Location and Size**

  Accurate and timely detection, identification, and location of ground targets and the determination of their size and disposition on the ground are essential for accurately computing firing data. Determining the appropriate time and type of attack requires that the target size (radius or other dimensions) and the direction and speed of movement be considered. Target location is primarily

determined by use of target acquisition assets and sensing platforms. Other sources include maneuver FSEs and special operations forces.[19]

- **Launcher Location**

  The PADS provides accurate survey data for survey control points used by launchers. Accurate firing point location is a function of the launcher SRP/PDS based on the initial survey data. It can also be derived at the firing point directly from GPS.[20]

- **Weapon and Ammunition Information**

  The ballistic algorithm imbedded in the EU of the launcher FCS takes into account specific ammunition information (weight, ambient temp, and ammunition type).[21]

- **Solution Meteorological Information**

  The effects of weather on the rocket must be considered and the firing solution must compensate for those effects. Use of current meteorological information in the FCS allows the firing solution to compensate for current weather conditions (see Chapter 4 for time and space validity considerations and responsibilities regarding met verification).[22]

- **Computational Procedures**

  The computation of firing data must be accurate. Special applications programs (SPAR) programmed in the launcher FCS yield accurate and timely firing data. Individual and collective training reduce the probability of procedural or data input error.[23]

MLRS Systems Capability and Munitions

SYSTEMS CAPABILITIES

The tremendous flexibility of the MLRS makes it an important fire support asset to maneuver commanders at all levels. The MLRS C3 capabilities; the organizational structure; and the system range, firepower, and munitions, all contribute to this flexibility (see Figure 2).[24]

Table 3-1. Range Comparison

SYSTEM	MIN RG	MAX RG
MLRS M26 Rocket (DPICM)	10 km[1]	32 km
MLRS M39 Missile (APAM)	25 km	165 km
Note: [1]Submunition dud rates increase at ranges less than 10 km. The system software will allow firing at ranges down to 5 km.		

Figure 2. Table 3-1 from FM 6-60

MUNITIONS

Launch Pod

Each M270 holds either two LPCs or two GMLAs (not a mix of the two) in the LLM (see Figure 3). Each launch pod contains either six rocket tubes or one missile housing in a containerized shipping, storage, and launch frame. Rockets and missiles are factory assembled and tested. Rockets are stored in fiberglass containers; missiles are stored in an aluminum enclosure with fiberglass camouflage panels on the exterior. Both rockets and missiles are then mounted on the frame. Both the rocket tubes and the missile housing are connected by cable to common electrical connectors. Not only are handling, transport, and loading fixtures similar, the LPC and GMLA are also visually similar.[25]

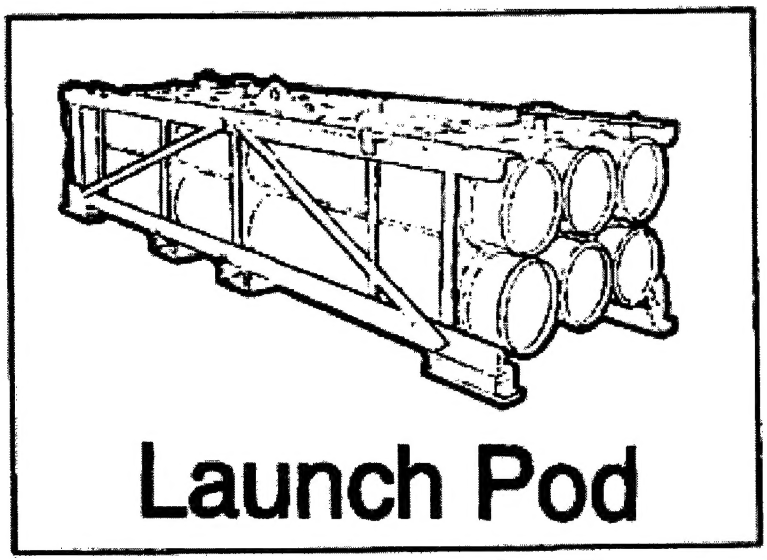

Figure 1-3. Launch pod.

Figure 3. Figure 1-3 from FM 6-60

The launch pod is 4.04m (13 ft 2 in) long (without skids) and 1.05 m (3 ft 5 in) wide. The height of the pod is 0.84 m (2 ft 9 in) with skids and 0.72 m (2 ft 4 in) without skids. When loaded with rockets (tactical or practice), each LPC weighs 2,270 kg (5,005 pounds). A loaded GMLA weighs 2,095 kg (4,609 pounds), and an inert training GMLA weighs 1,360 kg (2,998 pounds).[26]

Four aluminum bulkheads provide rigidity to the frame and support for the rocket tube or missile housing. Tiedown and lifting D-rings are located on the top of the frame at the four corners. A lifting rod is installed for lifting the container by the launcher boom and hoist assemblies.[27]

Stacking pins at the top four corners of the frame permit stacking of the launch pods. They can be stacked two high during transport and four high during storage. They can be handled by forklift, since they have two inner bulkheads that serve as support members. Each launch pod is marked for the center of gravity and proper lift areas.[28]

The detachable skids mounted to the bottom four corners of the frame must be removed from the pod before it is loaded into the LLM. A quick-release pull pin allows easy removal of the skids. The GMLA also has a lifting rod cover which must be removed before being loaded into the LLM.[29]

The changing of rocket and missile pods requires a repositioning of the loading hoist assembly system.[30]

Rockets

The MLRS rockets are tube-launched, spin-stabilized, free-flight projectiles. The rockets are assembled, checked, and packaged in a dual-purpose launch-storage tube at the factory. This design provides for tactical loading and firing of the rocket without troop assembly or detailed inspection. Major components of the rocket assembly include four stabilizer fins, a propulsion section, and a warhead section. (See Figure 4.)[31]

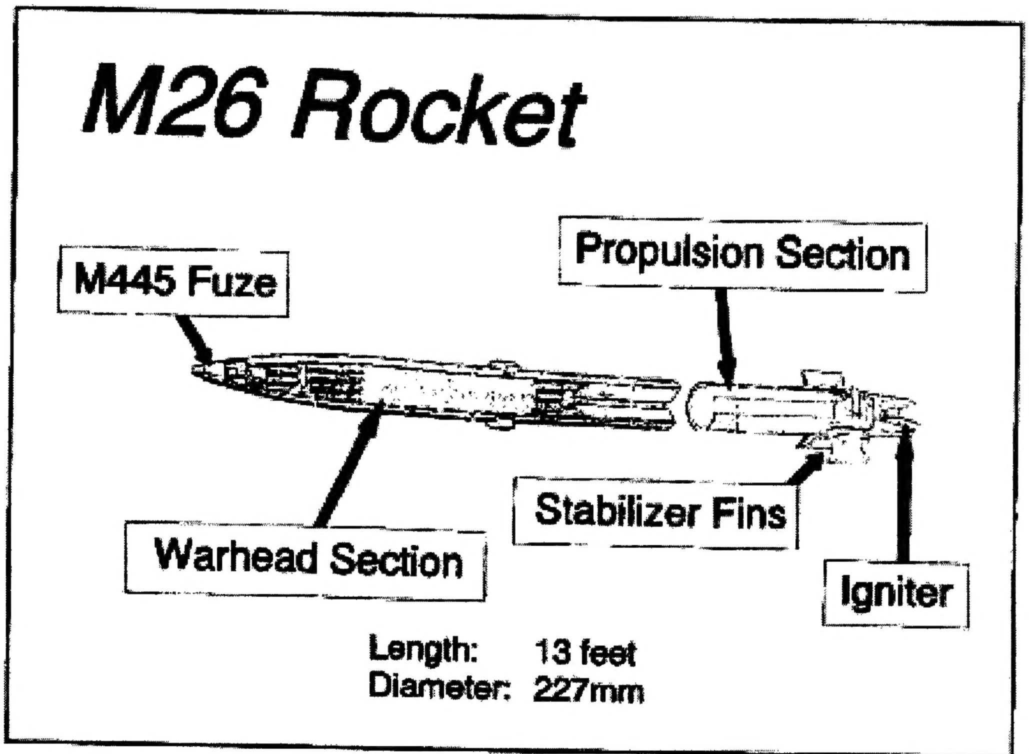

Figure 1-4. M26 rocket.

Figure 4. Figure 1-4 from FM 6-60

Propulsion for the rocket is provided by a solid propellant rocket motor. An umbilical cable, passing through the aft end of the launch tube, links the FCS to an igniter in the rocket nozzle. The motor is ignited by an electrical command from the FCS.[32]

Each rocket is packaged with the four fins folded and secured by wire rope retaining straps. As the rocket moves forward upon firing, lanyard devices trigger a delayed strap-cutting charge. After the rocket leaves the launch tube, the charge cuts the straps. This allows the fins to unfold and lock. The M28 and M28A1 rockets' LPCs have an additional fin release device to ensure deployment.[33]

The MLRS rocket follows a ballistic, free-flight (unguided) trajectory to the target. The propulsion provided by the solid propellant rocket motor is the same for each rocket, so rocket range is a function of LLM elevation. The four stabilizer fins at the aft end of the rocket provide in-flight stability by maintaining a constant counterclockwise spin. The initial spin is imparted to the rocket through spin rails mounted on the inner wall of the launch tube.[34]

<u>**M26 Rocket**</u>

This is the basic rocket for MLRS. It is used against personnel, soft and lightly armored targets normally with a target location error (TLE) of 150 m or less. Larger TLEs may reduce effectiveness. Each rocket dispenses 644 M77 dual-purpose improved conventional munitions (DPICM) submunitions over the target area.[35]

M26 Warhead Function

Warhead event is initiated by an electronic time fuze (M445) that is set remotely by the FCS immediately before ignition of the rocket motor. The fuze triggers a center burster charge. This causes the warhead to rupture, the polyurethane filler to shatter, and the submunitions to be spread over the target area.[36]

M77 Submunition Description

The armed M77 submunitions detonate on impact (see Figure 5). The antimateriel capability is provided through a shaped charge with a built-in standoff. The M77 can penetrate up to four inches of armor. Its steel case fragments and produces antipersonnel effects with a radius of 4 m.[37]

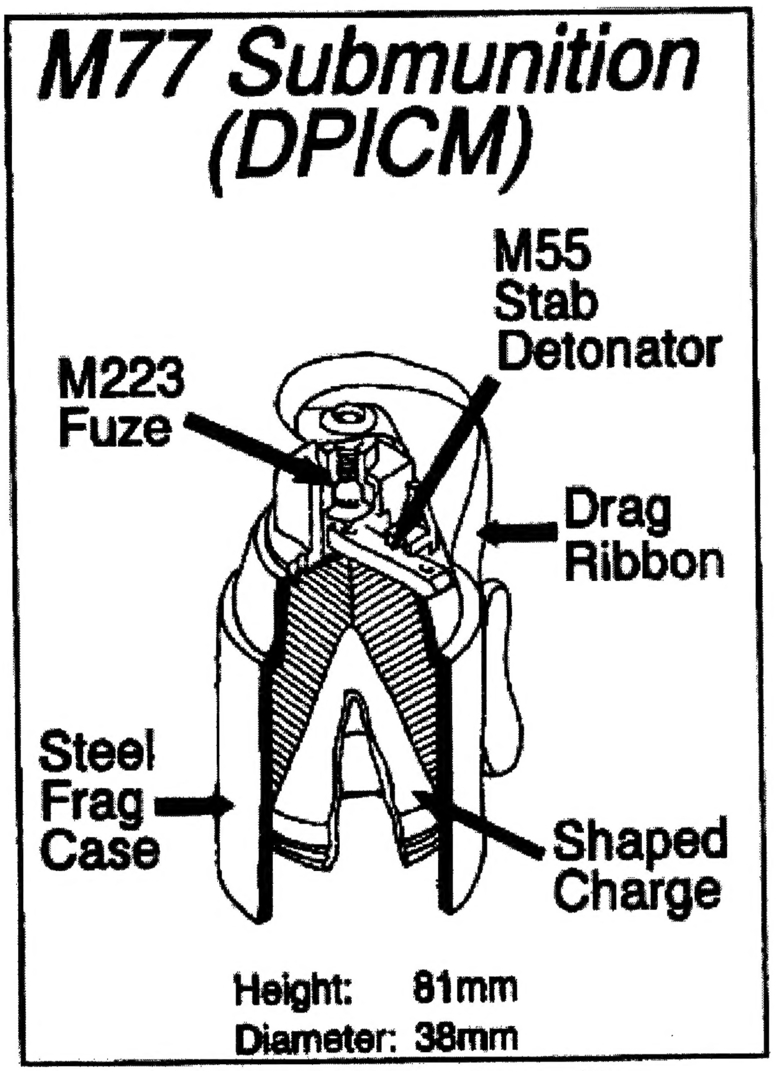

Figure 1-5. M77 submunition.

Figure 5. Figure 1-5 from FM 6-60

This rocket can attack targets at ranges between 10-32 km. Although system software allows firing at ranges as short as 5 km, the submunition dud rate increases significantly at ranges less than 10 km.[38]

Missiles

The Army TACMS missiles are ballistically launched, inertially guided missiles. They are designed to carry a variety of submunitions, to include "smart" munitions and lethal mechanisms to provide a wide range of future capabilities. Currently, the Army has only the M39 missile.[39]

Missile Assembly

The missile has four sections: the guidance and control section, propulsion section, control section, and the warhead assembly (see Figure 6).[40]

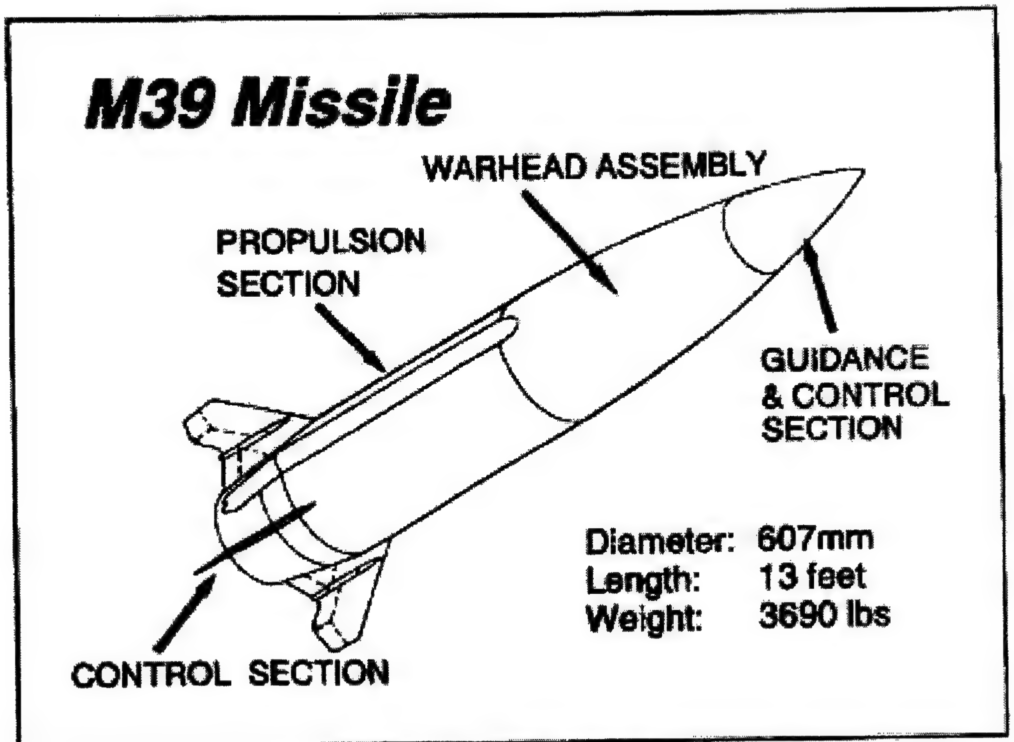

Figure 1-6. M39 missile.

Figure 6. Figure 1-6 from FM 6-60

Guidance and Control Section (GCS). The GCS provides all navigation, guidance, autopilot, and internal communications functions for the Army TACMS missile while in flight and for all ground operations. Continuous determination of position, attitude, and motion are provided by the inertial sensors, associated electronics, and software processing. Guidance and autopilot functions are provided by software processing within the GCS computer. All communications, both internal and external to the missile (missile to launcher and/or ground support equipment), are provided by the GCS electronics and software. This includes communications with the M270 FCS electronics for launch control, the ground support equipment for maintenance, and the control system electronics unit (CSEU) for missile fin

actuator control.[41]

Propulsion Section. The solid rocket motor furnishes the energy necessary to launch the missile and sustain missile flight for a sufficient time to meet Army TACMS altitude and range requirements. The solid rocket motor consists of a motor case, propellant, insulation/liner, nozzle, and igniter arm/fire assembly.[42]

Control Section. The primary functions of the control section assembly are to position the missile fins, provide the missile electrical power while in flight, and support selected pyrotechnic functions.[43]

Warhead Assembly. The primary function of the warhead assembly is to carry, protect, and dispense the missile payload. The warhead assembly consists of a rolled aluminum shell with aluminum support structures and front and rear bulkheads. A center tube connects the bulkheads and provides a central wire route. In addition to the payload, the warhead assembly contains a skin severance system which controls the release of the payload at the required time.[44]

M39 Missile Warhead

This warhead is used against personnel and soft targets normally with a TLE of 150 m or less. Larger TLEs may reduce effectiveness. Each missile dispenses a cargo of approximately 950 antipersonnel and antimateriel (APAM) M74 grenades over the target area. The M39 missile (Army TACMS Block I) has a minimum range of 25 km and a maximum range of 165 km.[45]

M39 Warhead Function. Warhead event is initiated by an electronic time fuze (M219A2) that is set in the same manner as the M445 electronic time fuze of the M26 rocket. The fuze detonates shaped charges mounted to the skin and bulkheads. This in turn severs the skin. By means of centrifugal force and airstream currents, the M74 grenades are distributed over the target area. Arming of the M74 grenades is accomplished by the spin action which is induced on the individual grenade.[46]

M74 Submunition Description. The M74 grenade is filled with composition B explosive filler and is covered by a steel shell (see Figure 7). Upon impact and detonation each grenade breaks up into a large number of high-velocity steel fragments that are effective against targets such as truck tires, missile rounds, thin-skinned vehicles, and radar antennas. This submunition is not effective against armored vehicles. The M74 grenade also contains incendiary material and has an antipersonnel radius of 15 m.[47]

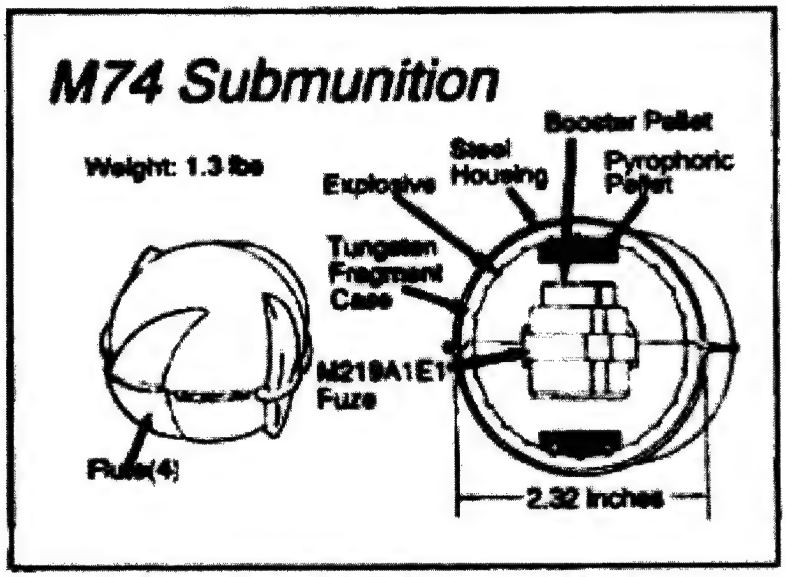

Figure 1-7. M74 submunition.

Figure 7. Figure 1-7 from FM 6-60

FUTURE DEVELOPMENTAL MUNITIONS

Rockets

Extended Range Rocket. The extended range (ER) rocket is an evolution of the basic M26 rocket that extends the range to 45-plus km. This greater range capability is achieved through a 20 percent reduction in the number of submunitions and a modified rocket motor. It has at least the same accuracy as the basic M26 rocket. ER-rocket accuracy is enhanced by an improved rocket detent located in the launch tube. Additionally, the wind measuring device (WMD), a component of the future Improved FCS, updates the firing solution prior to launch at the firing point with corrected low level wind readings. The effectiveness of the M26 rocket is maintained in the ERrocket even though the submunition payload has been decreased. This is due to the improved center core burster and a reduction in the dud rate, made possible by an improved drag ribbon design and the incorporation of a self-destruct fuze.[48]

MLRS Smart Tactical Rocket (MSTAR). MSTAR will be a robust smart munition warhead primarily employed against counterfire targets, but with capabilities to attack other moving or stationary, hot or cold targets. The munitions will be delivered by the ER MLRS rocket. MSTAR will provide the division commander with a highly responsive, fire-and-forget engagement capability against a wide variety of targets of tactical depth. MSTAR will offer greater lethality with reduced logistical burdens, minimize effects of huge target location errors, and reduce collateral damage.[49]

Extended Range Rocket (Guided). Low cost guidance for MLRS rockets seeks to integrate a guidance and control system into the ER MLRS to provide much improved delivery accuracy (2-3 mil circular error probable [CEP]). The demonstrated system will be designed to allow for the inclusion of a global positioning satellite (GPS) receiver and antenna in order to be postured for any future requirement in which very accurate (5 meter CEP) delivery errors may be required. Guidance for MLRS will

significantly improve the effectiveness of both DPICM and precision guided submunition payloads while reducing logistics burdens, mission times and collateral damage.[50]

Missiles

Army TACMS Block IA. The Block IA missile carries approximately 300 M74 bomblets. A GPS receiver will be integrated into the missile which allows it to receive positioning data updates for increased accuracy. The Block IA missile ranges targets from 100 to 300 km.[51]

Army TACMS Block II. Block II employs the brilliant antiarmor technology submunition (BAT). The Block II missile ranges targets from 35 km to 140 km. The Block II payload consists of thirteen BAT submunitions which are equipped with both acoustic and infrared sensors that give each submunition the capability of acquiring and attacking moving armor targets. After the dispense from the main warhead, each BAT submunition autonomously seeks an individual target within a moving armor column with its acoustic sensor. Once each submunition is close enough to its selected target vehicle, the inbred seeker is activatated and provides guidance during the terminal trajectory. The BAT submunition has a tandem shaped charge warhead designed to defeat all known reactive armor.[52]

Army TACMS Block IIA. Block IIA employs an improved BAT submunition that is effective against both hard and soft, moving and stationary targets. The Block IIA payload consists of six improved BAT submunitions which are equipped with sensors that give each submunition the capability of acquiring the target regardless of whether an inbred signature exists. The improved BAT submunition has a multipurpose design to kill both hard and soft targets at ranges that exceed the Block II missile.[53]

Nonstandard MLRS Missions

An MLRS unit may have to assume a nonstandard DS mission, because it is the only indirect fire asset available. Before assigning a DS mission to any MLRS unit, the following factors should be carefully considered:[54]

- The MLRS battalion lacks the fire support coordination personnel normally associated with a DS FA battalion. The organic liaison section is inadequate to satisfy this function.[55]
- Given its large footprint and greater range, MLRS DPICM is best used against area targets and to complement cannon fires.[56]
- Danger close for MLRS M26 rockets is 2 km.[57]
- MLRS fires are normally less responsive than cannon fires.[58]
- The MLRS has extensive ammo resupply considerations that adversely impact on its ability to sustain continuous fires.[59]
- The MLRS lacks the munitions normally required for a DS mission (for example, illumination and smoke).[60]
- The MLRS comm nets are insufficient for the DS mission.[61]

- The use of MLRS in the decentralized DS mode denies the force FA commander the use of an important asset needed to influence the battle.[62]

- Precision Error. Rockets are inherently less precise than cannon projectiles. They have a much larger CEP are therefore much less predictable.[63]

These missions amplify, limit, or change one or more of the inherent responsibilities or spell out contingencies not covered by those responsibilities. Examples of some nonstandard missions include those discussed below:[64]

- An MLRS firing battery answers calls for fire from a combat aviation brigade. The FDS can communicate digitally with an aerial observer in an OH-58D through the helicopter's airborne target handover system (ATHS). It also can communicate digitally with an observer using a digital message device (DMD) or other hand-held digital device in an OH58A or OH-58C helicopter. The battery FDC also can receive voice calls for fire from aerial observers. All of these configurations allow the MLRS firing battery to engage the variety of targets the aviation brigade can acquire.[65]

- A battery from an MLRS battalion is attached to a FA brigade which is DS to an ACR or separate maneuver brigade but remains GS to the regiment or brigade.[66]

- An MLRS battalion is attached to a FA brigade which is reinforcing a Marine Corps or coalition army force artillery headquarters. However, the MLRS battalion is positioned by and has its fires planned by the reinforcing FA brigade headquarters, not the force FA headquarters.[67]

- A nondivisional MLRS battery is GSR to a DS cannon battalion but is positioned by and has its fires planned by the reinforced FA unit headquarters.[68]

Conclusion

Planners must understand the full spectrum of fire support systems available for various combat operations. MLRS provides enormously powerful fires to a variety of targets. By understanding MLRS capabilities and limitations in MOUT commanders can exploit the system's strengths while mitigating against misapplication. MOUT conditions will continue to figure into future operations. Commanders and other trainers must begin now to consider TTP for ensuring steel on target.

Endnotes:

1. Headquarters, Department of the Army, ***Tactics, Techniques, and Procedures for Multiple Launch Rocket System (MLRS) Operations,*** **Field Manual 6-60,** Washington, D.C., 23 April 1996, Chapter 3. Internet Edition - Not Paginated.

2. Headquarters, Department of the Army, ***Tactics, Techniques, and Procedures for Multiple Launch Rocket System (MLRS) Operations,*** **Field Manual 6-60,** Washington, D.C., 23 April 1996, Chapter 4. Internet Edition - Not Paginated.

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7. Headquarters, Department of the Army, ***Tactics, Techniques, and Procedures for The Field Artillery Cannon Battery,*** **Field Manual 6-50,** Washington, D.C., 23 December 1996, Appendix F. Internet Edition - Not Paginated.
8. Headquarters, Department of the Army, ***Tactics, Techniques, and Procedures for The Field Artillery Cannon Battery,*** **Field Manual 6-50,** Washington, D.C., 23 December 1996, Appendix F. Internet Edition - Not Paginated.
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